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REPORTS

OF

SPECIAL COMMITTEE

ON

Vaccination and Sewerage,

MADE TO THE

BOARD OF HEALTH,

At its Meeting, May 1st, 1872.

LOUISVILLE, KENTUCKY.

BRADLEY & GILBERT, CORNER OF THIRD AND GREEN STREETS
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ANNUAL REPORT

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OF

SPECIAL COMMITTEE ON VACCINATION.

To the Honorable Board of Health of the City of Louisville :

Long and gloomy is the catalogue of physical sufferings to which man, placed at an immeasurable distance above other animals by his characteristic excellencies of material organization, and by the exclusive attributes of reason and intelligence, stands incessantly exposed—heavy the tribute which at the shrine of eternal and unerring justice he is called upon to pay for this proud pre-eminence in the scale of created being.

Civilization, too, with all her charms and blandishments, introduces among her favored children a train of evils and diseases which are almost unknown to the more wild and rugged walks of savage life.

Amid the sufferings and the diseases which this catalogue exhibits to our view, small-pox stands inscribed in distinguished characters of terror and devastation.

Yet terrible, most terrible, not merely from its extent, but from its nature and severity, are the ravages committed by this relentless foe of human happiness and enjoyment.

Her meagre and unsparing hand plucks not the hoary weeds, the fruitless thorns and brambles of our worldly wilderness. The sensitive plant, the lily, the passion flower, and the rose of human gentleness are as often the victims of her rapacity. Upon the cheek tinted with the warmest hues of youth, of beauty and intelligence ; upon the eye, illumined by the fire of genius and sensibility ; upon the heart, throbbing with benevolence and animated by all the gentlest and most noble affections that can adorn or dignify the human character, this fiend of desolation delights to prey.

The very name conveys to the generous mind a sensation of chilliness and dread. Whenever the loathsome sound strikes upon our ear, scenes of woe and wretchedness to which we have been witnesses flit across the darkened mirror of recollection—the venerable form of age, bent in silent anguish over the distorted features of all its earthly hopes and happiness; ardent and impassioned manhood, straining with convulsive agony to its widowed heart the putrid relics of plighted tenderness and truth; unconscious infancy, gazing with artless merriment upon the pustuled cheek of its faint and gasping mother, or perhaps drawing the horrible poison from her almost exhausted bosom.

These are scenes which your committee can never turn to contemplate without emotion. Against the depressing influence of such recollection, long familiarity with the disgusting spectacle of this human misery have not yet sufficiently fortified their nature. A more than common gloom, inspired by these meditations, and the indifference in those whose duty it is to oppose this desolating malady, hangs over them as they sit down to the performance of the task of promoting a more general adoption of the practice of vaccination, and to suggest such measures as are best calculated to avoid the evils that arise from the neglect of this great sanitary blessing. The *perfect* protection of *successful* vaccination has been thoroughly demonstrated all over the world; and every other country but ours has so *nationalized* this boon to humanity, that the masses are as familiar with its blessings as are ours with disfigured recoveries and loathsome death from its neglect. As early as 1802, vaccination was greatly recognized by all descriptions of people in Hindostan—in (Forbe's Oriental Memoirs, vol. 3), Moorperal Streenivasachary, a Brahmin, thus writes to Dr. Anderson, at Madras, on vaccine inoculation:

“I beg leave to observe, for the information of the natives of this country, that I have perused the papers which you have published on that wonderful, healthful, and immortal vaccine matter discovered on the nipple and udders of some cows in England by that illustrious physician, Dr. Jenner, whereby the loathsome, painful, and fatal small-pox has been prevented from seizing the many of our fellow-creatures in India, as well as in Europe.

“I am eye-witness, as well as many others, that numbers of children here have been inoculated with vaccine matter without any injury or blemish whatever; it is, therefore, greatly to be wished, that an intimate knowledge of this wonderful discovery may be acquired by the

natives of this country, so as to enable them to preserve the lives of the rich and honorable as well as those of low caste. On this account it might be useful to remove a prejudice in the minds of the people arising from the term cow-pock being literally translated *comary* in the advertisement which has been published in our Tamul tongue; whereas, there can be no doubt that it is a drop of nectar from the exuberant udders of the cows of England, and no way similar to the humor discharged from the tongue and feet of diseased cattle in this country.

Signed,

MOORPERAL STREENIVASACHARY."

It may not be out of place here to mention the following singular fact respecting the antiquity of vaccination in India, taken from the *Asiatic Register* for 1804, which is altogether a curious and authentic addition to a subject so interesting to humanity.

The fact stated in the translation of a written memorandum from the Nabob Mirza Mehady Ali Khan, who was long resident at Benares, that the effects of vaccination have been known for a great length of time in that celebrated quarter of India, will afford an ample field for the investigation of those who have the opportunity and ability, since they cannot want the inclination to prosecute so interesting an inquiry.

The undoubted intimation of this fact, that vaccination has been practiced among the worshipers of Bowannee, will not detract an iota from the merits of the Jennerian discovery. The fortuitous and happy circumstance which led to the discovery in Europe has been unquestionably and most satisfactorily proved, whilst the anxiety, study, perseverance, and indefatigable exertions which have been applied by its benevolent professor to insure the conviction of the world in the unbounded benefit of the discovery, have entitled him to the lasting gratitude of mankind.

The full ascertainment of the fact will only go to afford an additional instance of primeval oriental knowledge; whether acquired or accidental, is to be hereafter proved. It will only open an additional neglected mine for the curious and the learned, and will be another proof that the East has been the seat of wisdom, "where learning flourished and the arts are prized."

The translation here follows :

"During the period of my abode in the district of Benares, my eldest son being taken ill of a very bad kind of small-pox, and my friends

interesting themselves for my comfort and his relief, one of them named Slookum Chund, a Hindoo, pointed out to me that there was in the city of Benares one Alep Choby, a Brahmin from Oude, whose practice was chiefly confined to this malady.

"Him, therefore, I lost no time in sending for to the town of Gha-zeepoor, where I dwelt; and he arrived on the ninth day of the eruption. On seeing which, he observed that if the eruption had not taken place, he would have endeavored to facilitate and render it easy, but that now it was too late.

"In asking Choby what the process was, he said: From the matter of the pustule on the cow I keep a thread drenched, which enables me, at pleasure, to cause an easy eruption on any child, adoring at the same time Bowannee (who is otherwise called Debee, Alata, and Sebla, and who has the direction of this malady,) as well in my own person as by causing the father of the child to perform the like ceremonies. After which I run the drenched string into a needle, and drawing it through between the skin and the flesh of the child's upper arm, leave it there, performing the same operation in both arms, which always insures an easy eruption; on the first appearance of which the child's father or guardian renews his worship to Bowannee; and as the animal this goddess rides upon is an ass, it is customary for such parent or guardian to fill his lap with grain, which an ass is sent to eat up. These observances ensure the propitious direction of Bowannee, so that only a very few pustules make their appearance, nor does any one die under this process." Thus far did I learn from Alep Choby.

"Upon referring on this subject to a native well-versed in the learning and customs of the Hindoos, he told me that the practice thus described by Choby was not general among them, but confined to those who were attached to the worship of Bowannee, and adored her with implicit faith; and upon my asking this person whether he was aware how the matter of the pustule got from the cow, and whether all cows had such pustules, or only those of certain description, he answered that on these points he possessed no information, but had certainly understood the cows had those pustules break out on them, and from the matter thereof children were infected, acknowledging, however, that he spoke not this from ocular knowledge, but from report."

Fully appreciating the delicate task assigned them, and believing that it is expected of them to remove rather than add to the confusion already existing in the public mind upon this subject, your committee

deem it proper to avoid as far as possible the introduction of controverted topics, as well as any individual views they may hold in the premises.

In the consideration of a subject embracing such a variety of topics, the majority of which are but imperfectly understood by the masses, your committee deem it essential to offer a brief description of the phenomena of the perfect and successful vaccine vesicle. When vaccination has been successfully performed on a healthy child, the incision may be felt elevated on the second day, and, on the third, if examined with a magnifying glass, appears surrounded by a slight efflorescence. On the fifth day a distinct vesicle is formed, having an elevated edge and depressed center. On the eighth day it appears distended, with a clear lymph. The vesicle, on this, its day of greatest perfection, is circular, and either pearl-colored or slightly yellow. In its form and structure it resembles the pustule of small-pox. The margin is turgid, firm, shining, and wheel-shaped. It is composed of a number of cells, by the walls and floor of which the specific matter of the disease is secreted. On the evening of the eighth day an inflamed ring or areola begins to form around the base of the vesicle, which continues to increase during the two following days. This areola is of a circular form, and its diameter extends from one to three inches. When at its height, on the tenth day, there is considerable hardness and swelling of the subjacent cellular membrane. On the eleventh day the areola begins to subside, leaving, as it fades, two or three concentric circles of a bluish tinge. The vesicle before this has burst, and its surface acquired a brown color. The lymph which remains becomes opaque, and gradually concretes, so that about the end of the second week the vesicle is converted into a hard round scab of a reddish brown color. This scab contracts, dries, blackens, and about the twenty-first day falls off, leaving a cicatrix, which is permanent in after life, circular, somewhat depressed, striated, and indented with more or less pits, corresponding to the number of cells of which the vesicle had been composed.

The constitution generally sympathizes about the seventh or eighth day. The child is restless and hot, and the bowels are more or less disordered. This commonly subsides in two or three days. Many children pass through the disorder without the slightest indication of constitutional disturbance, which is not to be looked upon as by any means essential to the success of the vaccine process. About the tenth day a

papulous eruption of a lichenous character frequently shows itself on the extremities, and sometimes extends to the body. It continues for a week, and occasionally lasts after the scab has fallen off. This vaccine lichen is chiefly met with in children of full habit, where numerous vesicles had been raised on the arm, which discharge freely. It is an accidental occurrence, which, like the constitutional irritation, indicates a full effect upon the system, but is not deemed requisite to insure it.

Vaccination in the adult exhibits the same succession of phenomena. The vesicles, however, are thinner and more easily ruptured. The lymph is usually of a yellowish tinge, and the areola is more extensive. The glands of the axilla, too, frequently swell, which is rarely observed in children. Constitutional irritation commonly runs higher.

Believing that they have presented sufficient phenomena of successful vaccination to enable an observant community to recognize its genuineness, your committee proceed to the consideration of the *irregular and unsuccessful vaccine vesicle*. Imperfect vaccination is not characterized by any uniform sign or criterion, but exhibits in different cases different appearances, such as pustules, ulcerations, scales, and irregular vesicles. The most common form of irregular vesicles is marked at its commencement by very troublesome itching; so great, as to provoke scratching or rubbing, to which the subsequent appearances are generally, but most unfairly, attributed. The vesicle throws out a premature efflorescence, and advances too rapidly, so that on the fifth day it has attained its height, when it will be found raised on a hard, inflamed base. It is acuminate or conoidal, and gives very much the appearance of an ordinary festering sore. It is generally of a straw color, and contains, instead of clear, transparent lymph, opaque matter or pus. The succeeding scab is small, of an amber color, and drops off by the tenth day.

In pursuance of the original design of this paper, your committee may briefly allude to some of the prevailing prejudices or distrusts in the public mind with regard to the subject under consideration.

The most reasonable of these is, perhaps, the familiar fact of failure in the successful performance of an operation requisite to the production of a disease rendering small-pox nugatory. This is a matter of grave import—not only to the philosopher and the community at large, but to the physician also, and, as such, demands a careful and unbiased elucidation. The attention of Dr. Jenner was early directed to investigate the impediments to perfect vaccination, and the circumstances

which interfered with its protection. He contended that vaccine virus, originally good, might become, from a variety of causes, so deteriorated in quality as to produce a local disease, but no such constitutional influence as is necessary to insure protection against small-pox. Towards the close of his life, Dr. Jenner was of opinion that *pre-occupation of the skin* was the grand impediment to the success of a vaccine vesicle. A popular belief with the public is, that the vaccine virus deteriorates by passing through a succession of human bodies. This theory was never countenanced by Dr. Jenner. The elevation and pearl-like aspect of the vesicle of the present day, the extent and shape of the areola, the color and form of the resulting scab, all correspond precisely with the earliest delineations and descriptions of Dr. Jenner. Your committee are not acquainted with anything that can possibly interrupt or prevent the constitutional operation of the vaccine virus in a susceptible subject, excepting a morbid state or action of the system, or constitutional excitement inimical to vaccine disease.

Perhaps the strongest prejudice to be combatted in the minds of the people arises from an impression of the existence of a *spurious* vaccine matter and a *spurious* vaccine disease. This doctrine may be traced to the written and oral opinions of the earliest vaccinators, who did not discriminate between an imperfect and defective operation of the system and a supposed specific matter which has since been thought capable of producing a specific spurious disease. Great stress has been laid upon this subject, without offering the least direct or convincing proof of the reality or existence of such an article as spurious cow-pock matter. From whence does it proceed, and where shall we search for it? Does it originate in the cow, and is it thence perpetuated by inoculating the human body--or is it spontaneously generated in man? Is it durable, ephemeral, or variable? By what regular characters can it be detected, judged of, and described? And why, if it be a specific contagion, does it occasionally arise from the use of genuine cow-pock matter? It appears somewhat remarkable that many of these points have hitherto been only carelessly adverted to by persons who have endeavored to engage the sanction of the public in instituting a vaccine establishment, sounding the alarm and danger of a spurious matter, and ascribing the want of success in vaccinating to the use of it.

Having alluded to the deficiency of proof respecting the existence of a specific spurious vaccine virus, your committee would not be at a loss to substitute opinions and inferences on this subject, apparently

more consistent with facts and practical observation, to account for the irregularities or deviations which have been construed into marks of a spurious disease. They, however, do not think it proper at present to do so.

The next error of sufficient gravity to demand your consideration is a conviction on the part of the more intelligent portion of the community that vaccination is a prolific source of cutaneous disease.

On the subject of eruptive diseases no authority ever stood higher than Dr. Willan, who has said, after the most careful examination, that no new disorders have appeared since the discovery of kine-pock: that he has investigated many cases that were attributed to kine-pock, but found diseases well-known and described a thousand years ago, common diseases of the skin, having no connection whatever with vaccination. The number of diseases of the skin, instead of increasing, has diminished since the introduction of this preventive, in proof of which facts were adduced by Dr. Willan and others, who assert that vaccination has a decided advantage over small-pox, measles, and scarlet fever in not exciting other diseases. Dr. T. S. Bell, in a paper published in the third series, seventh volume of the *Western Journal of Medicine and Surgery*, says: "Nor is there any reason for believing that a vaccine scab can communicate any other disease than the cow-pock, even if taken from children laboring under scarlet fever, measles, whooping-cough, scrofula, or anything of the kind. Physicians are often charged with giving scrofula to children by vaccinating them with matter from scrofulous children. It would be as rational to charge any other subsequent event of a child's life to the same cause."

Believing that they have impartially set forth the more prominent prejudices of that class in whose behalf this effort is instituted, your committee beg your consideration of a class holding a more intimate relation to the cause we advocate—allusion is made to those already vaccinated. Are they protected? The Jennerian doctrine so often quoted, "That when once the human frame has felt the full force of genuine cow-pock it was never afterwards assailable by small-pox, establishes the conclusion that the majority undoubtedly are." But the question still recurs: What is the law which regulates the subsequent liability to small-pox, when the vaccine process has been *imperfectly* gone through, and when, from some peculiarity of habit, the system receives only a *portion* of that salutary influence which cow-pock is capable of imparting.

Dr. Jenner held that under such circumstances "small-pox would recur, and that the degree in which its phenomena were modified was proportioned to the degree of perfection which the vaccine vesicle assumed during its development."

Dr. Willan holds the same view in regard to the permanency of vaccination when the process is perfect.

The medical department of the English Privy Council is of opinion that by early vaccination, if thoroughly performed and successful, most people are completely insured for their whole lives against small-pox. If, however, this early vaccination is imperfectly performed, or from any other cause unsuccessful, the protection is much less satisfactory. In consequence of imperfect vaccination, the population always contains very many persons who, though nominally vaccinated, and believing themselves secure, are really liable to infection. The authority above quoted holds that the best infantile vaccination sometimes loses more or less of its efficacy in process of time, and recommends, that all persons who have been vaccinated in infancy should, as they approach adult life, be revaccinated, which, if successfully performed, does not require repetition; in proof of which it is said that the re-vaccination to which nurses of small-pox hospitals in England invariably submit is a perfect protection.

Whatever difficulty there may be in determining the exact number in which vaccination failed to impart perfect and permanent protection, it is clear that vaccine failures are sufficiently numerous to arouse public attention, if not disgust.

Your committee are of opinion that this disgust and these failures will continue so long as this simple operation (elevated into a science by its immortal founder) is entrusted to the *gebrueyten hebmawen* and barber, instead of the observant, pains-taking physician.

Should we, therefore, be surprised at the growing distrust in the public mind as to the protection offered by vaccination?

The physician should feel it indispensably necessary to conduct the process of vaccination with the greatest attention, through *all* its stages, and until its complete operation upon the system has taken place, and he should ever be ready to repeat the process, if any irregularity or deficiency in the first shall have been noticed.

It may be suggested, for the proper discharge of this important duty—which should always (if practicable) be entrusted to the responsibility of the physician—that a regular period of attendance should

be observed throughout the *whole course* of the disease—and especially on the third, fifth, seventh, and ninth days—and lastly, that the unerring test proposed by Bryce (which consists in performing a second vaccination on the fifth or sixth day after the first) should be resorted to in case of doubt or necessity.

Your committee have endeavored to present, from the limited material within their reach, such facts as clearly elucidate the points to which they have directed their efforts, and respectfully submit them for your deliberate consideration, hoping they may convince your honorable body of the urgent necessity of the adoption of legislative measures requiring their observance.

Respectfully,

J. WOOD CRAWFORD, *Chairman.*

REPORT

OF

SPECIAL COMMITTEE ON SEWERAGE.

At a regular meeting of the Board of Health, DR. J. J. O'RIELLY offered the following :

WHEREAS: Many fatal cases of Typhoid Fever have been lately reported, which were attributed to imperfect connections between dwellings and sewers, and the Council being about to ORDER pavement sewers on some of our streets, we think it becomes this Board to enquire into the best mode of sewerage connection and ventilation; therefore, be it

Resolved. That Dr. Bell, Dr. Rogers, and the City Engineer be appointed a special committee to examine into this question and report immediately to this Board.

To the Honorable Board of Health of the City of Louisville :

GENTLEMEN—The question thus submitted to your committee is one of the most important that can engage the attention of the people of Louisville. It comes home, directly or indirectly, to every inhabitant of the city. It addresses itself to the highest interests of every one; it should take a firm hold on every understanding. The investigation of it demands a thorough knowledge of the entirety of all the elements of the subject, because a single mistake may vitiate the force even of partial truths that may be mixed up with the mistake. The time has passed, we hope forever, when assertion was taken for knowledge; when an authoritative name gave currency to the weavings of the imagination. We approach the investigation of this momentous question in that spirit of scientific inquiry which has been well-portrayed by a master as the armory of the man of science. "He has no favorite theories to which he is wedded; no cherished traditions which he feels himself bound to sustain; no personal biases to which the evidences of the senses must yield; no foregone conclusions which are permitted to vitiate the exactness of investigation. Truth is the fair ideal of all intellectual endeavor; the supreme object of all scientific inquiry; the essential element of all human progress. He who does not make it

paramount in the pursuit of knowledge is a charlatan, an imposter, a swindler, no matter by what dignified titles he is called. He who substitutes his own fancies, or his own interests, or his own prejudices, for the majesty of truth, defiles the temple of the soul, and offers to the Lord the unclean sacrifice of a lie."

SEWERAGE HISTORY.

The department of knowledge embraced in the subject before us is called hygiene. It is very properly divided into public and private hygiene, and both divisions are involved in the inquiry submitted to your committee. They are, comparatively, of very recent birth, for it is very certain that they did not take rank as a comprehensive and exact science earlier than 1844. Those who are familiar with the medical reputation of Dr. J. A. Paris, of London, and with the legal eminence of J. S. M. Fonblanque, barrister at law, will readily recognize that they were thorough masters of their respective professions, but their great work, very great in its day, on medical jurisprudence, the result of their joint labors, published in 1823, betrays an ignorance, a narrowness of domain, a want of grasp, and a degree of uncertainty, in comparison with that which the world has attained since 1844, that unfits it now for teaching even the alphabet of hygienic science. In 1844 the pressure of extensive avoidable sickness, and the enormity of a death-rate that was known to be unnecessary and preventable, aroused the potent powers of parliaments and of empires, and the accumulations of hygienic knowledge speedily created a hygienic science that demanded a recognized place among the necessary powers of governments. There is not a European power that has not armed itself for the welfare of its people with all the potencies of a hygienic department, through which all that can be done is done for preventing avoidable sickness and avoidable death. In this country these great measures for the public welfare are almost totally neglected by State governments; as far as they are used, they owe their restricted, feeble powers to the flickering and uncertain manifestations and misgivings of municipal regulations. Were it not for the animus of the medical mind of the country, that will not silently look on preventable evils of this description, the public and private suffering would be almost immeasurable.

THE ABSENCE OF VENTILATION.

The terrible disasters of many centuries, in the experience of desolating pestilence in the shape of black-death, sweating-sickness, the

plague, and typhus fever, which often decimated empires and almost depopulated large cities, awakened attention finally to the necessities of improved dwellings, of drainage and ventilation; but even these curative means, when imperfectly or improperly done, had their manifold evils. London spent many millions of dollars on a sewerage system that transferred evils from one point to another, and carried disasters to parts that were previously free from them. This should awaken the attention of the people of Louisville. So far as mere sewerage is concerned, this city is well-equipped in all those portions that are sewered, and the drainage is successfully accomplished. But is this all that is to be done? If we stop at this a serious battle against disease and death begins at this very point. Drainage may materially arrest the ravages of consumption; but what does the community gain if typhoidal diseases are distributed by the gases of the drains? That this can be done, that it is done, stands upon irrefutable testimony given at numerous points of observation. A great many imperfectly informed persons suppose that if the sewer has a good outfall, if its contents flow freely, and if flushing of water is attended to, all is well. A more fatal error can scarcely be conceived. The flushings of traps and drains with water very frequently produce the very evils they are intended to prevent. They let loose deleterious gases that were imprisoned, and invite them from the sewer into the dwelling. Until we learn to do what is at present impossible, how to make two different things occupy the same place at the same moment, it will be beyond human power to prevent the evil of which we speak. Whoever may succeed in filling a bottle at the same moment with its full measure of each, air and water, may consider that he has made progress toward curing one of the most urgent of the calamities of sewerage.

AUTHORITIES ON FRESH AIR.

In *Dombey and Son*, one of the most masterly of the works of Mr. Dickens, he says: "Breathe the polluted air, foul with every impurity that is poisonous to health and life, and have every sense, conferred on our race for its delight and happiness, offended, sickened, and disgusted, and made a channel by which misery and death alone can enter. Vainly attempt to think of any simple plant or flower, or wholesome weed, that, set in this fetid bed, could have its natural growth, or put its little leaves forth to the sun as God designed it." It is difficult to conceive of the magnitude of the evils that would spring up in a well-sewered

city without perfect sewer ventilation, but for the growth of plants, flowers, and wholesome weeds. They are the scavengers of the air, and, when abundant, they do their work on some of the gases most effectually. Any one may see this effect on carbonic acid gas by taking a clean bottle of clear water and breathing into it a short time. The water becomes milky in its hue from the presence of carbonic acid gas. Put a sprig of living mint into the bottle, cork it up, and the mint speedily cleanses the water and restores its clearness. A lustration of air, similarly contaminated, goes on constantly where accessible vegetable life grows abundantly.

Mr. Dickens, in *Dombey & Son*, says further: "Those who study the physical sciences, and bring them to bear upon the health of man, tell us that if the noxious particles that rise from vitiated air were palpable to the sight, we should see them lowering in a dense black cloud above such haunts," as those described above, "and rolling slowly on to corrupt the better portions of a town." In the open air the laws of elasticity and diffusibility of gases are something of a safeguard against this rolling, but what is to be done when sewers for drainage are canals for carrying "noxious particles that rise from vitiated air," and which force themselves through the house drainage pipes into the rooms of the finest dwellings of the city, and find egress into the streets from every sewer-opening and crack? There are devices that are well named traps, that are theoretically supposed to catch and hold in water noxious gases rising from the sewer. There is no truth in the theory. The water in the trap soon becomes surcharged with the gases, and gases easily escape through the water. If the water in the trap is flushed with fresh water, imprisoned gases escape past the water, and enter the house, or contaminate the outside air. As far as these devices catch and hold the understanding in the error we have named, they are indubitably entitled to the name of traps. There are few catch-basins that are entitled to confidence. The very best devices of this kind are liable, very liable, to get out of order, according to the testimony of all European engineers who have qualified themselves to speak on this subject; for, in order to be qualified to speak about it, an engineer must be chemist enough to know whether gases escape from sewers and drain-pipes or not, and he must be intelligent as to their effects on human beings when they do escape. James Lovegrove, Esq., associate of the Institution of Civil Engineers, England, in a paper read before the Society of Arts, is very emphatic on portions of this

great subject. He says "he was led to attach considerable importance to the subject of sewer ventilation in consequence of having, in many instances, observed in houses, where sanitary works had been carried out, a larger amount of effluvia after the execution of drainage works than existed before." Mr. Lovegrove says: "Twenty different forms of traps in general use are all dependent on being constantly charged with water, and may be easily proved to be inefficient for the purposes for which they were designed, and for these reasons should be condemned." Traps that are dependent on a film of water should not be relied upon too confidently; the water may evaporate, or disappear from other causes, and then the trap becomes a flue for drawing the pernicious gases of the sewer or water-closet into the house. Mr. Lovegrove, after mentioning a number of drains becoming untrapped in hospitals, residences, &c., gives the following instructive case, which should speak forcibly on this whole question: "In a public hospital, near Portman Square, a brick drain, in direct connection with the sewer, passed sewer air inwards so strongly as to blow out the flame of a candle. This drain continued through the building, and received in its way the raised sink-inlets, also the drainage from the lavatories, sinks, and water-closets on the upper floor. In this case, when water was passed from one or the other of the inlets, *it caused the contained air first to press against the water in the inlet water-traps, and, on reaction, to draw off sufficient water to untrap the inlet.* Thus, through one or other of the inlets, air was generally escaping into the house." The italics are ours.

In some drains, Mr. Lovegrove says, "the more water that is thrown into (them), the more effluvia will escape. The slimy coating, also, of the interior of a long length of drain is, of itself, sufficient to contaminate the contained air, no matter what fall the drain may have. In the methods just described, the one idea has been an unsuccessful endeavor to stop the opening from which the smell escaped, without inquiring if this or that opening is stopped what will become of the foul air, what new state of things is produced, and what are the influences actually at work. Certain it is, that the mode generally adopted of trapping inlet-drains favors the escape of sewer air into the houses."

ENGLISH HORRORS.

A recent case of sickness and threatened death in England has roused the attention of the civilized world to this subject. The sickness of the Prince of Wales was caused by ill-ventilated sewerage, by which the noxious gases escaped through the drains into the houses, and the death of

Prince Albert, his father, was due to the same cause. Londesborough Lodge, the residence of the Prince of Wales, was thoroughly drained and well supplied with "traps." But the sewers were not properly ventilated, and the mind of England has awakened to the fact that there is scarcely a sewer in England that is ventilated for safety. Sidney Smith said that the public would never rouse up to the disasters of railroad traveling until a Bishop was mangled, and now the slumbers of the empire have been broken by the disaster of the Prince of Wales, traceable to the great evil of badly ventilated sewers. There is scarcely a single house in England, connected with sewers, that is guarded against the ingress of noxious exhalations from the sewers. We do not know of a dwelling-house in Louisville thus connected that is safe from such destructive visitations as typhoid fever and kindred types of disease. The investigations of the masters of sanitary science in England satisfactorily show that the dwellers in houses connected with improperly ventilated sewers, sleep among agencies that may at any time burst forth with destructive powers, and many notable occurrences are recorded in which these evils manifested themselves unexpectedly and disastrously. The ravages of typhoid fever and kindred evils have been mapped along unventilated sewers connected with the dwellings of the sufferers. In a very able paper on "The Study of Sociology," in the Popular Science Monthly, Herbert Spencer, one of the great thinkers of the age, gives specimens of the mode in which great problems are ignorantly managed. In alluding to the disasters at Londesborough Lodge, Mr. Spencer says: "Why did those in authority allow such defective sanitary arrangements? was everywhere asked after the fever at Lord Londesborough's, and this question you heard repeated regardless of the fact that sanitary arrangements, having such results in this and other cases, were themselves the outcome of appointed sanitary administrations—regardless of the fact that the authorized system had itself been the means of introducing foul gases into houses." In a note Mr. Spencer says: "Of various testimonies to this, one of the most striking was that given by Mr. Charles Mays, M. B., of New College, Oxford, who, having had to examine the drainage of Windsor, found that, in a previous visitation of typhoid fever, the poorest and lowest part of the town had entirely escaped, while the epidemic had been very fatal in good houses. The difference was this, that, while the better houses were all connected with the sewers, the poor part of

the town had no drains, but made use of cesspools in the garden. And this is by no means an isolated instance."

LOUISVILLE'S NEGLECT.

There are two truths of the greatest gravity on this subject that are incontrovertible. They are, first, that in such connections as we have described, the escape of poisonous exhalations into dwellings is a certainty; second, that they are at all times inimical to health, and may at any time be inimical to life. Are positive, absolute evils of this kind to be neglected? Among the valuable services rendered to this city by Dr. Henry M. Bullitt, while performing the duties of Health Officer, were his earnest efforts to provide safeguards against the poisonous breath of open-mouthed sewers. Had his warnings and admonitions been properly heeded, the present demands for security against these evils would be comparatively trivial. Neglect has piled these imperative demands mountain high. The apparatus for breathing is the chief organization for the perfection of every vital force. This apparatus is not only very delicate about its food, but is very much more fastidious about the character of its supplies than the digestive apparatus. Professor Benjamin Silliman says, in his *Principles of Physics*: "If the air of a crowded apartment is conducted through water, so much animal matter is collected in the water as to occasion a speedy putrefactive fermentation, with a disgusting odor. The blast of air escaping from the upper ventilator of a crowded assembly room is so oppressive as to produce immediately the most distressing symptoms." Suppose this air is not carried off; that it does not escape through an upper ventilator, but is repeatedly breathed, can it fail to be most pernicious to health? Alas, that people should have a vast deal to learn about as universal a usage as breathing. Professor Silliman continues: "While we instinctively shun all contact with unclean persons, and what we call dirt, even refusing a cup that has pressed the lips of another, and esteem all water not transparent as foul, it is marvelous with what thoughtlessness we resort to crowded and ill-ventilated public places, and drink in the subtle poison exhaled from the lungs, skin, and clothing of every individual in the assembly. Especially when we remember that the digestive apparatus can select and assimilate nutriment from food of a questionable quality, the lungs have no such power of selection, and can discharge their duty to the constitution only by a full supply of pure air. If the transparency of air

was troubled by exhalations of the lungs as water is by the washings of the body, no argument would be needed to secure attention to the importance of ventilation; and yet it is quite true that the bodily health suffers more from inhaling effete air than it could from drinking the wash alluded to." We wish to impress this so that it may not easily be effaced from the memory. Dr. Guy, in his lectures in King's College, on public health, quotes Fletcher as stating that "he had been in a Channel cruiser when the water for above a week was more fetid than the very worst bilge-water," so that the men were "obliged to suppress their sense of smelling" when they used it; and yet "their health was never better." Fletcher adds "that his ship, the *Swallow*, was ordered three times up the Ganges in the very worst season; when the thermometer stood at 89°, when an exposure for a few minutes upon deck wetted them to the skin; when the dead bodies floated on the stream in such numbers that it was difficult to make a passage among them; and yet on all these occasions the vessel left the river without losing a man." The lungs are not, in the least degree, tolerant of aberrations from the purity of their supplies. Professor Silliman says: "Headache, languor, uneasy respiration, nausea, faintness, and syncope are the results which always follow from breathing air contaminated with these poisonous exhalations" (carbonic acid gas), "even in very moderate quantity. Even two per cent. of carbonic acid, derived from breathing or combustion, may produce all the symptoms above described." Think of the enormous percentage of accumulated sewer exhalations that may suddenly find their way into dwellings, the evils of which must be far beyond those arising from two per cent. of carbonic acid.

AUTHORITY AGAIN.

In the March number of the *Manufacturer and Builder* we find such an excellent and perfectly correct description of the evil which we wish to impress on the Board of Health and the active attention of the people of Louisville, that we make full quotations from it. That periodical says:

"The possibility of our residences becoming infected through exhalations from sewers is a fact which engineers and builders seem to entirely overlook. While we are discussing the best means of discharging and employing our solid sewage at the outfalls, we are thoughtlessly allowing the most insidious, subtlest part of the poison of the

gaseous form of it to enter unchecked into our very dwellings. That the sewage begins to give off gases as soon as it enters the drain our builders appear to entirely ignore. Its composition begins to be resolved into its elements, gases of small specific gravity become liberated, and the liquid and solid portions roll to the lowest point of the drain. These light gases, among which is sulphuretted hydrogen—one of the most deadly—naturally rise to the highest points of the drain, and these points are the soil-pans of water-closets and the sinks. The *Building News*, in an exhaustive paper on the subject, says:

“ Now, let it be considered that two bodies cannot occupy the same space at the same time. Supposing all these traps to be perfect in construction and always charged with water, the action is this: that when water is poured down a sink or a water-closet or from any other source, a volume of air—which in this case is loaded with sewer gases—must be displaced equal in volume to the quantity of water delivered from the drain. The quantity of water daily delivered into the house drains is about five cubic feet for every individual inhabitant. In the night time very little sewage flows down the drains, the drains being then chiefly occupied by air more or less loaded with the gases derived from the decomposition of the sewage. As soon as people become active of a morning, and begin to deliver water into the drains, the gases within them—always supposing the most favorable circumstances of the traps being perfect—become displaced by the more powerful action of the liquid, and again, supposing the traps to be perfect, they become compressed; but it is a law of nature that all elastic bodies, such as these gases, re-act with a force equal to that by which they have been compressed. The cubical capacity of the drains and sewers is constant, but the quantity of sewage flowing down them varies from hour to hour of the day. The variation is so great that it is found that one-half of the whole quantity of sewage due to the twenty-four hours runs off in from six to eight hours, and at certain times as much as three times the average hourly flow takes place. These fluctuations in the quantities of sewage cause constant compression and expansion of the gases in the drains. Now, water does not afford a complete block to the passage of sewer gases; it quickly absorbs them, and when the water has become saturated with them a slight increase of elastic force on one side of a trap is sufficient to disturb the equilibrium, and cause the gases to rise into the house on the other side. This action takes place when the traps are in the most perfect condition; when imperfect, it is needless to point out how readily sewer gas passes through them.

“One or two imperfect water-traps are the only safeguards against the entrance of the deleterious gas, and these are too frequently worthless, either on account of an undue force of the ascending gas, or because of the thin layer of water that supervenes in the traps. In dealing with a remedy for the existing evil, the question arises, can we dispense with the evil altogether by removing the source of it? This may be done. 1st. By dispensing with indoor closets altogether. 2d. By using earth closets. 3d. By adopting some means of cutting off or disconnecting the injurious means of the connection of the sewage effluvia and the house through the soil-pipe. The impracticability of adopting either of the former plans in a large town under present arrangements is too obvious to require attention. The remedy must be applicable, if possible, to existing houses, to be of any great immediate value. The disconnection of the closet or sink and sewer in any manner to prevent the sewage gases, always light and therefore ascending, from entering the house, is the problem to be solved. This may practically be effected by vent-shafts or air-pipes, carried from the highest points of the traps or soil-pipes, either through a fire-flue or at the side of one above the roofs, so that the gaseous products should be carried away innocuously. The provision for the gaseous matter is not dreamt of in our present unscientific system; the gases are thus virtually compelled to escape through any unguarded channel or inefficient trap whenever the descent of the solid matter or the downward rush of water compresses it or displaces its natural volume. Ordinarily, such safety-room or vents may be served by the length of soil-pipe; but whenever this gas is incompressible, by reason of the limited capacity of the drains or pipes, the traps are useless, and the gas finds its liberty through our closet-pans or up our sinks. Not only should the closet of every house be provided with a vent-tube of sufficient size, but the same provision should in all cases be made at the entrance of the sewer, or the sewer itself be ventilated at proper intervals by lofty shafts, so that the escape of this gas may be rendered easy under peculiar pressures or conditions, and at the same time relieve other houses. In the country, where cesspools are used, they should have such tubes carried up from them at the side of trunks of trees, etc. By this plan the descent of the drainage matter from the house could not be checked by the sewage gas, the latter being driven before it, instead of finding a passage through the descending or outrunning matter. There is a difficulty often in carrying a vent or air tube up a chimney, as fire-flues are not

often near water-closets. In these cases it would be better to place the soil-pipes outside of the house if possible, its highest point being ventilated in the above manner, in a line continuous with it, the closet-trap inlet being introduced through an intermediate trough exposed to the air. By this means the ascending sewage gas would naturally take its straightest upward course, the closet-matter and flushing of every action of the water-valve helping to drive the gas up its appointed channel, instead of through an imperfect water-trap.

“The main sewers should, on no account, have those objectionable and offensive open gratings adopted in many places in towns, which can not be sufficiently condemned, for though it may be urged that offensive gas passes off in such small quantities and is so readily diffused that it can scarcely be considered injurious, this is a fallacy, as any portion of it is injurious, and demands that it should be wholly removed to the region of the air where it can do no harm. The same scientific authority, Dr. H. Clark, F. S. A., of Russell Square, further says: ‘The use of vent-tubes is no new idea, but they promise adequate security against upward pressure of the gas, the drains being well-trapped in all other respects: 1st, by having a deep water trap at the outlet and close valves to the closets; these, as they now exist, have generally a very imperfect water-valve, easily overcome by any accidental upward pressure, and the pan, having usually a side tube to allow any overflow of water to pass away through the perforation at the upper part of the pan, affords also a free ingress of gaseous matter when the pressure is sufficient to overcome the water in the bend of the pan-shaft.’ Instead of the loose pan or dish at the bottom of the ordinary pans, there should be an accurately fitting flap to retain sufficient water above it: a similar expedient is recommended in regard to waste-pipes, which should have metal valves at their inlets to soil-pipes; these valves, being counterpoised and holding just sufficient water to keep the ordinary soil-pipe connection with the trap, provide for only one condition, the outlet of the matter, and every time this takes place a portion of gas is forced aside or comes into collision, instead of having another and distinct passage provided. By the means here proposed, or a similar arrangement, (by which the closet-matter and gas are both provided for without interfering with each other), all new closets, and even the old ones, may be constructed free from the errors that have lately been illustrated with such import.

“It can not be supposed that a thin layer of water in a trap can ef-

fectually prevent noxious smells from entering a house, for liquids absorb gases, and the water in our closets and drain-traps is often saturated with the poisonous gas to such an extent that the air becomes contaminated by it. This is another reason why an improved sort of trap or valve is imperatively required in the existing arrangements.

"It is probable that very few of our most intelligent citizens have ever reflected upon the possible distribution of deadly poison among the inmates of their dwellings and even their palatial residences from the common drain of the whole city population.

"It has generally been supposed that when the streets are kept clean and the sewers in good order, municipal prudence has nothing more to do. It is very certain that in the present atmospheric condition of our Eastern cities the epidemics of the season will make rapid strides without these sanitary precautions. But we need to look further. We have shown very clearly that the foul and disease-laden air of the public sewer can and does obtain admission into our chambers through the soil-pipe, the bath outlet-pipes, and the pipes which connect our bath-rooms with the subterranean drain.

"It is very clear, too, that there must be a constant pressure of the sewer-air on the pan or trap of the closet, which must inevitably lead to an infiltration of the poisonous vapor into the house. If we suppose that the excremental matter which passes through the sewer in epidemic seasons is capable of conveying disease, as we know it is, the most cleanly and elegant mansions on our finest avenues, and even our sumptuous suburban villas, are seen to be in direct communication with the most filthy and putrescent nests of disease in the worst tenement houses.

"The open pipes in the houses (which are also introduced into every bed room), in performing their functions in removing waste water, are so many vents for the deadliest vapors confined in the sewerage. The foul air returns and insinuates itself into our houses by more than one process. A wind pressure, exerted on the open mouth of the sewer at a great distance from the house, or such a pressure on any street corner sewer opening, at once sends the infectious miasm into the internal atmosphere of our dwellings. The increase of the specific gravity of the external atmosphere also forces the sewer air into our nostrils. Even the draft of chimneys in a tight building, and especially when it is closed up at night, must be fed and kept up partly through the numerous small pipes which connect with the general sewer drain.

"As our London contemporary, *Nature*, suggests, the pneumatics of the private dwellings are quite as important as the hydraulics, and the dozen or more small pipes of sinks, baths, etc., should every one be made to empty, not directly into the sewer, but should be collected and 'allowed to discharge their contents into the open air over a trap communicating with the house-drain, so that reflux of sewer gas into the house would be simply impossible.'

"We regard this suggestion as of unspeakable importance in the technical details of house-building, and especially of all flats, tenement houses, and hotels. A man's home is of more consequence to him than the whole outside world, and if our modern science is worth anything it should bring itself to our hearths and firesides. The *London Times* well says of this matter: 'What a satire on the universal diffusion of knowledge, on the lectures of the Royal Society, on hundreds of scientific and educational institutions, and on all our new inventions and discoveries! Here is the simplest thing in the whole world, which wanted only common sense, and nobody seemed to have thought of it—nay, we are not sure that our architects and builders will be thinking of it next year. It is far too simple and too deadly an affair.'

SEWERAGE AND NO SEWERAGE.

The fact cannot be too thoroughly engraved upon the memory of the people, that while thorough drainage of human habitations is an essential element of health, the proper ventilation of sewers and house-draining pipes is quite as absolute in its exactions for health and security as drainage of the most perfect description. The sciences devoted to these two agencies, that are vital to the public welfare, are quite distinct in their character. That department of civil engineering which provides for drainage is an old science. Under Augustus Cæsar the sewerage of the Pontine marshes near Rome made the Campagni di Roma one of the most beautiful spots in the Roman Empire. The utter destruction of the drainage has made the entire region one of the most pestiferous of the earth. In the past three hundred years not a solitary stranger has slept in it at night without dying. The progressive march of knowledge, the concurrent observations of all civilization, have created a new science, called 'sanitary engineering.' It begins its work where that of the civil engineer ends. The greatest perfectness of drainage is in no degree free from the necessity of the labors of this new science. In an address to the National Association for the

Promotion of Social Science in England, Dr. Rumsey said : " In addition to watering and draining towns, the engineer is now called upon to provide fresh air artificially, to ventilate not only buildings, but whole towns." In Europe an immense amount of knowledge on this subject has been gathered from facts connected with sewerage. A report was recently submitted to the British Association, the joint labor of a number of the best informed men in England on this subject, in which these facts are announced : " But even in places where the water supply has been improved, where a system of sewerage has been adopted, and other measures have been taken with the object of getting rid of excremental refuse, the fact that the rate of mortality has not been sensibly, if at all, diminished, appears to point to some circumstance as yet insufficiently guarded against, which still exercises a prejudicial influence. The imperfect or defective nature of the sewerage may in some cases be the cause to which this result is referable. *But the part of the sewerage system which most urgently demands attention at the present time is the ventilation.*" [The italicising of this sentence is our work.] " Gases of a poisonous nature are freely given off from liquid sewage in passages above the sewers from deposits collecting in them and in the house drains. The gases naturally ascend the sewers, and find egress either into the streets of a town or into the dwellings by the means of the house-drains and otherwise. The means adopted for getting rid of those gases without injury to the sanitary state of a town, or of the houses in it, are rarely such as to be effective, and the returns already obtained in reference to this matter sufficiently show that attention has not been directed to it in a degree commensurate with its importance."

When we state that Dr. Angus Smith was one of the committee who submitted this report to the British Association, we express to all scholars in sanitary science, and to all students of it, the immense value that belongs to the quotations we have made from the report. Dr. Smith has recently published a paper on Disinfection and Disinfectants, which has attracted a great deal of well-deserved attention in England. His facts are of the most weighty character, and should make a profound impression on the people of Louisville. We quote from an excellent paper in Youman's Popular Science Monthly for May, 1872, by William Eassie, a civil engineer, some of these facts. Mr. Eassie says : " For the purposes of this chapter, however, I can not forbear condensing the remarks of Dr. Angus Smith, with respect to disease generally. According to this authority, the classes of disease may be caused—

firstly, by gases easily diffused in air, such as carbonic acid, nitrogen, marsh gas, and others; secondly, by vapors falling in cold air and taken up in fogs, volatile bodies in fact, that concentrate in cold temperatures, and not to be classed with gases; thirdly, by putrid or decomposing substances, that include with the hurtful gases named under the first head many organic forms, which, transferred to a suitable soil, are capable of working havoc with life and health; and fourthly, by those more organized bodies in various stages and ferments that have a definite existence, and that multiply the diseases to which they are most allied, whenever they meet with suitable fields for propagation."

These are definite points: they are facts as well-known to men of science as indubitable truths, as much so as any of the axioms of mathematics. On the subject of disinfection and disinfectants, we shall speak in another part of this report.

In the quotation of the *Building News*, we present to the consideration of the Board of Health one of the plans that have been suggested for securing people, whose dwellings are connected by drain-pipes with the public sewers, from the noxious gaseous and vaporous emanations of those useful conduits. They are exceedingly perilous, and, unfortunately, may first make their presence known in devastating and fatal sickness. It is impossible to be too guarded against the approach of enemies that sound no trumpet for their warfare--that do not address any of the five senses. They make their desolations among the vital forces.

WHERE CAUTION IS NEEDED.

The plans for the perfect disposal of the noxious exhalations of sewers and drain-pipes, which we quote from the *Manufacturer and Builder* for March, have some elements of usefulness in them. But great caution is necessary in connecting the ventilating shaft of the drainage-pipes with chimneys or flues. What may seem to be a very small error theoretically in matters of this kind, may practically prove to be the source of disaster. It should never be forgotten that currents in air are the products of difference of temperature and variation of pressure. Professor Silliman says: "The perfect freedom of movement in air renders its fluctuations from these causes incessant. If the air was visible, every candle, gas-light, stove, furnace-flue, and human body would be seen to be the center of a column of heated air, whose place was constantly supplied by other and colder particles. On the law of equilibrium of fluids, the ascending currents must induce others, descend-

ing and horizontal, and thus a circulatory motion is imparted, even by a single lighted candle, to the whole gaseous contents of a quiet apartment." Thousands of conclusive experiments demonstrate the truth of these statements. Dr. Silliman says further: "Chimneys draw because the products of combustion discharged into them are specifically lighter than the outer air." * * Among the sources of reversed draughts are: "When two flues open into one apartment, or two connecting apartments, and there is a fire in only one flue." Hence, the objection we have urged against connecting the ventilating apparatus of the sewers with any of the flues of a dwelling. The partnership may bankrupt health. Again: "When a powerful fire exists in one part of the house, as the kitchen, for instance, without an adequate supply of air from without, it will draw the needed supply through the smaller flues in all parts of the house, reversing the draughts in them; when (as in many old houses) the flues are so large that cold currents may descend in the angles, while a heated one ascends the axis, when a neighboring higher house or eminence directs, in certain states of the wind, a cold current down the flue."

REMEDIES SUGGESTED.

Each of the scientific facts we have mentioned is of great importance in hygienic matters, and they can not be safely neglected in the ventilation of sewers and drainage pipes. The abominable looking material that is often seen spread upon the streets in welling up the visible contents of sewers, should prepare the thoughtful mind for an estimate of the masses of invisible noxious agencies that are the inevitable products of the filthy substances drawn from the sewers, which invisible masses we propose to draw up and disperse into the upper regions of the air; where, under the laws of elasticity and diffusibility that govern gases, their commingling properties, remote from the breathing organs, may render them harmless. To secure a draft through these ventilating pipes of the sewers, an Emerson ventilator, or as it is often called, ejector, is one of the best and most useful of all the methods known to us. The top is cone-shaped; above it a disc of metal stands upon four substantial short pillars. The principle of its action is obvious. A current of air—the air being constantly in motion—strikes the cone, and rises so as to impinge upon the disc of metal; this accelerates the movement of the current, and causes a draft up the ventilating pipe. This excellent apparatus is cheap and is easily made. It is of the last

importance that every householder, whose building is connected with the sewers, shall see that the plan of ventilation is made perfect, so that there shall be no chance for failure, because all expenses for failures is money thrown away and security wasted, the result of which must be that sickness shall be produced. Those who desire perfect security against these evils will find great advantage in capping every flue or chimney, as well as the ventilating pipe of the drainage apparatus, with an Emerson ventilator. There are many of these excellent scientific contrivances about this city, and we have never heard of the failure of any one of them. One first-rate windy day in the spring or fall, when the chimneys, instead of drawing air upwards, reverse their action and draw sweeping gusts of wind downwards, and scatter soot and ashes over carpets, curtains, beds, and furniture, is more costly each time of this kind of draft than Emerson ejectors for every chimney of the house. They enable housekeepers to dispense with soot-bags, that being the name of the means resorted to for corking up the chimney when the necessity for fires in them ceases for the season. The public authorities owe it to those who confide these interests to their keeping, to secure all the public sewers against the leakage of noxious gases along the surface, whence they crawl into contiguous dwellings. For the preservation of health and life, these are matters of the highest importance. There seems to be a notion that apathy, indifference, and neglect are great inconveniences, but as a general rule there is inconvenience in being sick or in dying, and this is a matter of grave consideration. We know of no subject of greater moment that can be entertained by a board of health; we cannot suggest anything that more intimately concerns the welfare and prosperity of the citizens of Louisville than the proper ventilation of the public and private drainage.

THE DELUSIONS OF PRESENT SAFETY.

Let no one take up the perilous delusion that past escapes are a guarantee of safety for the future. Some of the gaseous poisons are too uncertain as to the time and circumstances of their attack to be trusted very long. The restraining powers which limit their activity may be suddenly withdrawn, and then disaster may be as unexpected and sudden as the withdrawal. The vital forces are never free from insecurity while deficient or impure air enters the lungs. And if the dwellers in palatial domiciles are insecure from the gases of leaky sewers, what must be the fate of the poor in their wretched dwellings?

They have ills enough to contend with in their battle for life without having noxious gases from the poisonous nostrils of sewers added to the burden. And we feel that it is within the purview of this hygienic protest to urge upon the municipal authorities the inauguration of efficient means for preventing the growth of a monster evil connected with contaminated air—we allude to the overcrowding of human beings in dwellings and lodgings, workshops and manufactories, where the supply of air is altogether inadequate to the sustentation of even tolerable health. The evil is already in this city. Means should be taken to nip it in the bud, and to prevent its reappearance. If there is perfect propriety in the efforts of an individual to prevent a suicide when he has the power to do so, is it not perfectly proper for the city authorities to take efficient measures for preventing the evils of involuntary suicide? This physiological crime of overcrowding inmates in habitations is more easily prevented than removed after it is rooted. In securing well-drained or dry, sun-lighted and well-ventilated habitations for the people, we materially diminish the statistics and mortuary records of consumption, a fact which sanitary tables place beyond any chance for controversy. If it is a wise and wholesome course for municipal legislation to provide measures for the removal of defective drainage, and of all evil things connected with it, is it not incumbent on the same legislation to see that other monstrous but preventable evils against health and life do not spring up in their place and keep up a criminal mortuary record, criminal because avoidable? The overcrowding of which we speak is one of the most probable of these evils, and should be curbed effectually. It is an evil that usually crawls silently and slowly into action. As property enhances in value, space becomes an article of active, competitive traffic, and the marts of fashionable manufactures crowd poor workmen and workwomen into working-places most wretchedly supplied with air and ventilation. There are now in this city slaughter-houses of this kind, in which sewing-girls are compelled to work almost at the starvation point of air-space. The battle for bread with these girls is one waged at the same time with disease and death, and the latter often becomes the victor in the strife. Should such outrages as these be permitted in a civilized, Christianized community? Dr. Hales calls pure air the "genuine cordial of life," and, as Heaven gives it copiously and free of cost, why shall any one be permitted to stint the poor of their full supply? Can the municipal authorities justly turn their backs on evils, growing evils of this kind?

How can they, as public servants of the people who confide in them, have any higher duties for recognition and performance than those which sanitary science joyously and fully accepts as its mission, a mission which imperatively demands ceaseless activity, namely: "To prevent disease, preserve health, and prolong life—to maintain the whole people in their highest efficiency, for the labors of peace or the struggles of war." The public authorities may rely on the Board of Health for all the aid that it can give in carrying forward these beneficent duties. But they are not confined to the municipal authorities, nor to boards of health. They belong to every member of the community, and each individual should be faithful, zealous, and intelligent in the recognition and performance of these duties? When all work with a will, with fidelity and appropriate knowledge of the subject, and in harmonious action, there will not be a necessity to look down the vista of time for the coming good period, for it will be found that it has already arrived.

COMMON AND DANGEROUS ERRORS.

While delivering the great truths of public and private hygiene, we should do our duty imperfectly were we to fail to try to impress upon the public mind the necessity of guarding against that prevalent error, which assumes that deodorizing and disinfecting are one and the same thing. It is difficult to find conceptions more utterly unlike one another than those conceptions. A thing may be perfectly deprived of odor, and retain perfect possession of its power of infection. There is no odor in the contagion of small-pox. A small-pox scab may be deodorized, and then be capable of giving the disease in its worst form. The garlic odor of burning arsenic has nothing whatever to do with the virulence of its poison, nor has the odor of illuminating gas anything to do with its luminous qualities. The foul odors of decayed animal structures do not produce any known disease, while the most generally diffused and fatal of the pernicious gases is altogether without odor, color, or taste. Let no one indulge the perilous delusion that in removing odors from dangerous material he has thereby deprived it of its power to do evil, or that he has necessarily mitigated that evil power. Sanitary science has extensive knowledge of deodorizing agents; its knowledge of disinfecting powers is very limited. We know that heat equal to one hundred and eighty-three degrees of Fahrenheit's scale entirely disinfects the poison of small-pox, of the rattlesnake, and the cobra di capella, but we know of nothing else that will do this. Facts of a clear,

undoubted character are much needed on the subject of disinfection. They are at present very scarce. During quite a number of years chloride of lime has been ranked as a disinfectant. Sanitary science now wholly discards it from any such agency. Additional experience with some of those that now enjoy favor in some quarters will, we are persuaded, consign at least a portion of them to the fate of chloride of lime as a disinfectant. Mr. Eassie, in the paper from which we have quoted, alludes to an article in a recent medical journal which refers to the *Odysey* of Homer for the practice of disinfection. It is in the twenty-second book of that poem, and is described as the act of Ulysses immediately after he had disposed of the suitors of Penelope. Pope fails to give the fullness of the Homeric language, and we prefer quoting the Oxford translation. While still in his rags, Ulysses addresses Euryeia: "Bring sulphur, O old woman, as a remedy for ills, and bring me fire, that I may fumigate the palace." She was ashamed of his mean appearance, and entreated him to let her "bring a cloak or tunic for his broad shoulders, covered with rags;" but Ulysses impatiently replies: "First of all let me have fire in the palace," and Euryeia brought fire and sulphur, "with which Ulysses well-fumigated the palace, the house, and the hall." As George William Curtis said of another matter, how like an artesian well do the works of Homer bore into the sanitary science of antiquity. The method of fumigation used by Ulysses is still a potent agency in many cases. But, in the matter of disinfection and disinfectants, there is a simple and infallible method of safety far superior to the entire list of articles that are supposed to disinfect noxious materials. That simple method is prevention. The intelligent physician has in the salts of Peruvian bark a power over intermittent fever that is as nearly infallible as anything in pharmacy for any disease, but common sense says that the prevention of the disease is far superior to the cure after even a single paroxysm. This is equally true respecting the diseases that spring from sewer gases. Prevention of sewer poison is immeasurably more beneficent than the most perfect cure of its causes of disease.

THE FUTILITY OF CATCH-BASINS AND TRAPS.

We can not too earnestly admonish the people against putting their trust in catch-basins, traps, or any device of the kind, unless there is with these contrivances a shaft-ventilation. We need no other fact to fortify this admonition than this: that the most perfect stoppage of

leakage of gases from the mouth of sewers does not prevent, but rather promotes, this leakage at every man-hole along the course of the sewer. About this there can be no kind of controversy. That is the only safe sewerage that provides for escape of noxious gases into the upper regions of the air, and fills their places in the sewers and drain-pipes with wholesome air. For the attainment of these objects, Mr. Lovegrove, from whose able paper we have already quoted, has devised an excellent plan for preventing the evils of sewer gases. It is excellent in providing for ventilating tubes. The necessity for a good method is so important that we give the suggestions of Mr. Lovegrove in all their fullness. He says: "There must be provided

"1st. A ready and proper outlet for the escape of the drain air under pressure.

"2d. A means of supplying air to the drain to follow the outflowing water.

"3d. Such a construction of the inlet traps as will effectually prevent the escape of drain air.

"The way in which these three principles may be applied is as follows: The outlet-trap is fixed at or near the point where the drain is connected with the sewer, and is made in one piece, with a syphon-dip to shut off the sewer air, and an air-exit tube passing over the syphon-dip. Then, at the mouth of the air-tube, a light metal air-valve is placed, so as to open outwards from the tube into the sewer on receiving a light pressure from within. Thus, when water is discharged into the drain, or a decided difference of temperature exists, the pressure of the air is exerted on the inner face of the valve, which then opens and allows the drain-air to pass into the sewer. The syphon-dip, without the shackle-flap, is admissable at the outlet of a ventilated drain, as it is always charged with water. Then, at the several inlets are fixed valves to work freely, with syphon-dips behind them, excepting the water closets and scullery sinks. The valve shuts off the drain-air, whether there is water in the trap or not, and the syphon-dip prevents the escape of drain-air during the period of the flow through the upper part of the valve. No amount of pressure from within the drain, or atmospheric influence from without, can affect the efficiency of these traps. Next, in any part of the drain (near the extremity is best), is placed an air-supply post, containing a light air supply valve, which opens inward to the drain on a light pressure, so that when the water is emptied into the drain (having first displaced air through the outward

air valve) flows out of the drain, it is followed by a supply of air through the air-supply post. The more water discharged into the drain, the more frequent will be the removal of air. *In the application of this principle to a drain having inlets at a considerable elevation, in lieu of the air escape at the outlet traps, an air tube is carried from the highest point of the drain to a height as far as possible from the windows and the influence of chimney down-draught.* The inlets are secured by the same mode as that just previously described, a common syphon at the outlet, and the air supply valve fixed near the outlet of the drain. *By this mode a current of air is obtained from the lower part, passing through the drain, and discharging above the roof.* In many instances air supply is obtained freely through the valve-sink inlets.

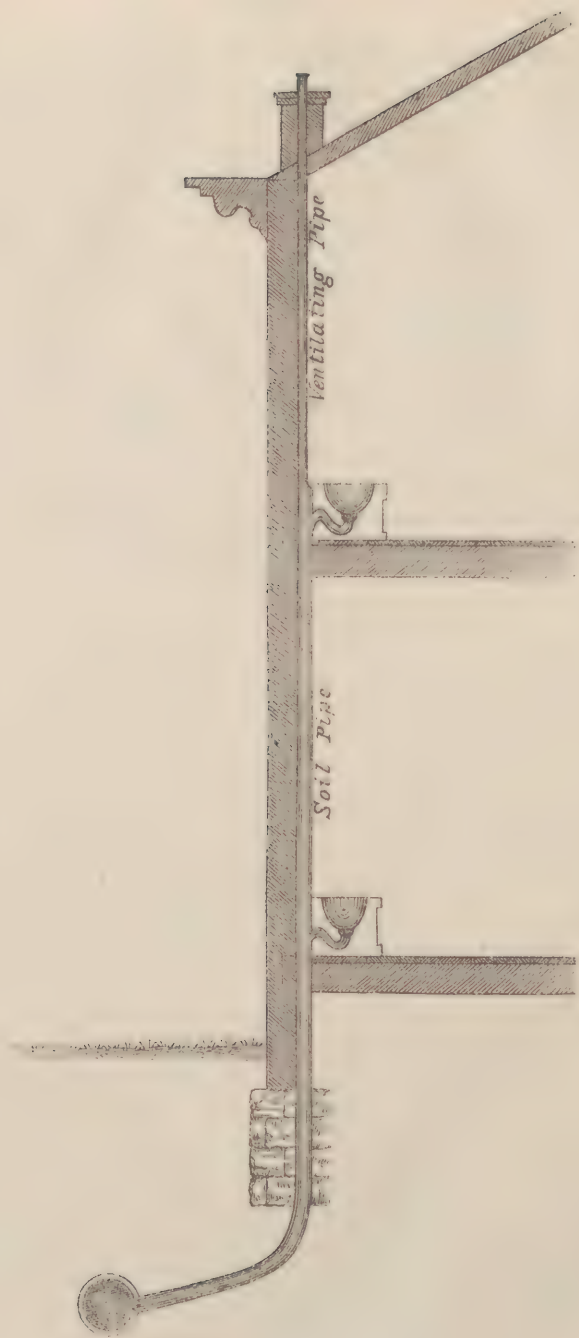
“ In the case of a house-drain connecting into a pipe-sewer, in order to obtain a ready access to the air-valve and syphon-dip, the air tube is continued on to the surface side of the dip, where it receives a box containing the air-exit valve. The air tube thence continues down to the outlet side of the dip, and the air is discharged into the sewer.”

LOVEGROVE'S PLAN REVIEWED.

In this masterly paper, Mr. Lovegrove shows that he is thoroughly acquainted with the evils of sewerage, and the poisonous qualities of sewerage gases. His remedies, embracing, as they do, elevated shafts for ventilation, are of great utility. The only objection that we have to the plan is based on its valves, which may get out of order, and the dependence placed upon water in the traps. This is very liable to failure, and the first announcement of this failure may be serious sickness in the family. We have italicised the redeeming feature of the plan, in which an elevated ventilating shaft is commended. In that, Mr. Lovegrove says the height of this shaft must be carried “as far as possible from the influence of chimney down-draught.” The height of this influence is unknown, and for this reason we have recommended the Emerson ventilator, not only for the top of the ventilating shaft of the sewer and drain-pipes, but for each chimney-top, in order to prevent “chimney down-draught.” The ventilating shaft should be of the same size as that of the inlet and outlet openings, and it must be recognized as an *essential sanitary feature* of sewerage and house-drainage. In the management of all sewerage and house-drainage two vital truths must be accepted and acted upon: First, that gases are almost absolutely irrepressible; which is proven in the fact that they permeate the

body of the cast-iron pipes that convey illuminating gas. Second, that, as the prevention of their escape from sewers and drain-pipes is well nigh impossible, the part of wisdom is to favor their escape, but under a controlling guidance that infallibly removes them from all possible chance of doing harm to the lungs. That city which supplies all of its inhabitants with full amounts of unadulterated air, which is very cheap and very free when labor or money is not expended in curbing its action, will have the most healthful population, the least of preventible sickness, the smallest death-rate.

In order that ventilating pipes for the removal and disposal of noxious gases shall be used properly, we present a plan for this purpose, drawn, at our request, by Mr. Booth, of the City Engineer's corps. This pipe, with an Emerson Ejector at the top, will be very effective in guarding dwellings from the noxious gases that, according to their character, have been known to produce diptheria, typhoid fever, cholera, fatal diarrhœa, and various forms of wasting diseases.



CONCLUSION.

We have thus, to the extent of our power, reviewed the whole subject intrusted to us by the Board of Health, and have given the recorded observations of a number of masters in the various departments of the subject, in order that you may give them to the people of Louisville for their comfort and welfare. We felt compelled to notice some of the evils of adulterated air, apart from the adulterations made by sewer gases. They all belong to the same category, and demand equal attention. There are few cities that have more perfect means for securing copious amounts of pure air for all their inhabitants than Louisville possesses. Nothing but a want of a sense of duty, put to active use, can deprive any citizen of this natural and vital boon. There is not an educational element for the duties of citizenship that is of greater utility, for public and private welfare, than that embraced in what is called public and private hygiene. Yet it is so sadly neglected, that its clearest and most valuable truths fall in stony soil that produces no fruit. In an able series of lectures, delivered by Dr. Guy, in King's College, London, he says: "Hygiene is a very large and comprehensive science. It has to do with persons of every rank, of both sexes, of every age. It takes cognizance of the places and houses in which they live; of their occupations and modes of life; of the food they eat, of the water they drink, the air they breathe; it follows the child to school, the laborer and artisan into the field, the mine, the factory, the workshop; the sick man into the hospital; the pauper into the workhouse; the lunatic to the asylum; the thief to the prison. It is with the sailor in his ship, the soldier in his barrack; and it accompanies the emigrant to his new home beyond the sea. To all these it makes application of a knowledge remarkable for its amount, and the great variety of sources whence it is derived. To physiology and medicine it is indebted for what it knows of health and disease; it levies large contributions on chemistry, geology, and meteorology; it co-operates with the architect and engineer; its work commends itself to the moralist and divine, for," Dr. Guy adds, "the destitution which attracts disease repels religion."

It will be a great gain to humanity when the universal mind of men determines to take nothing as true that is not proved by the rigorous rules of logic; when everything that concerns the welfare of mankind shall be a universal study for enlightenment. Is it too soon to begin this important work by investigations of hygienic facts and laws? They

vitally and intimately concern every human being from the time the first breath is drawn to the solemn scene when "the heavy dews of death cover the manly brow." This science should be taught in the nursery, in the schools, and in the universities, until every one is thoroughly equipped for the battle of life, for whoever enters upon that warfare, ignorant of the facts and laws of hygiene, enters upon the contest unarmed against a power armed at every point. We earnestly commend the whole subject to the consideration of the Board of Health.

We are respectfully,

T. S. BELL,
L. ROGERS,
T. P. SHANKS.

